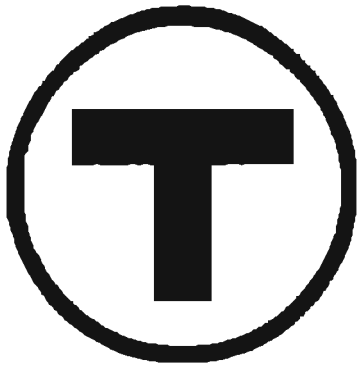

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

RAILROAD OPERATIONS

COMMUTER RAIL

MATERIAL SPECIFICATIONS

November, 1992

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
COMMUTER RAIL MATERIAL SPECIFICATIONS
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BUMPING POST

MATERIALS

Bumping post shall be constructed with structural grade steels. Tension member shall be produced in conformance with ASTM A663 Grade 60 and structural shapes shall be produced in conformance with ASTM A36.

DESIGN

Bumping post shall be in accordance with MBTA Standard Plans and shall be equipped with a cushion head with curved striking face for use with passenger coupler.

INSPECTION

Bumping post is subject to inspection on delivery.

SHIPMENT

Bumping post shall be shipped unassembled with all materials and instructions required for erection included.

DELIVERY

To be accepted bumping post must conform to this specification in all respects. Bumping post is subject to inspection at time of delivery and shall be at supplier's risk until accepted. Bumping posts rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 3010

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

CROSSTIE - TREATED

MATERIALS

Crossties shall be manufactured such that a minimum of 90% of the order is from Group A and the remainder of the order is from Group D below:

Group A - All Oaks
Group D - Beech, Birch, Cherries, Hard Maples

Anti-splitting end plates shall be galvanized steel plate in accordance with MBTA Standard Plan.

DESIGN

Crossties shall be 8 feet 6 inches in length and shall be 7 inches by 9 inches in cross section with a maximum of 1 inch of wane allowed in the rail bearing areas. A maximum of 30 percent of the order may be 7 inches by 8 inches in cross section with no wane allowed in the rail bearing areas.

The lengths and thicknesses specified are minimum dimensions. Ties over one inch wider or thicker, or over three inches longer, at any point, than the dimensions specified above, will be rejected.

Anti-splitting end plates shall be 6 inches by 7 inches and shall be installed in accordance with MBTA Standard Plan.

Anti-splitting end plates shall be embossed with letters and figures a minimum of one-half inch in height. Embossing shall include the following:

Authorities idenitification - MBTA
Last two digit of year treated - 93
Producer's name or symbol-XXCo.

Finished identifing brand shall appear as:

MBTA-93-XXCo.

and shall be positioned along the top of the plate on the 7 inch side.

MANUFACTURE

Crossties shall be manufactured from sound, live timber and must be free from any defects that may impair their strength or durability as crossties as further described in this section. Every effort

APPROVED: John D. Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

should be made to get the felled timber to mill and milled timber to treatment facility for seasoning as quickly as possible, to avoid wood fiber infection.

All ties shall be straight, well sawn on four sides, cut square at the ends, have top and bottom parallel and have bark completely removed. A tie will be considered straight when a straight line along the top, from the middle of one end to the middle of the other end, is entirely within the tie and when a straight line along a side, from the middle of one end to the middle of the other end, is everywhere more than 2 inches from the top and bottom of the tie. The top and bottom will be considered parallel when any difference in the thickness at the sides and ends is less than or equal to 1/2 inch. Crossties shall be free from the following defects:

1. Decay - Ties that show decay of any nature and ties that show stain from being left in the log too long will be rejected. "Blue stain" is not decay and is permissible in any wood.

2. Holes - Ties will be rejected if a large hole, or numerous holes with the net effect of a large hole, is present. A large hole is one exceeding 1/2 inch in diameter and 3 inches deep within the RBA*, or more than one-fourth the width of the surface on which it appears and 3 inches deep outside the RBA*.

3. Knots - Ties with a large knot, or numerous knots with the net effect of a large knot within the RBA* will be rejected. A large knot is one whose average diameter is greater than one-fourth the width of the surface on which it appears.

   *RBA - Rail Bearing Area - the area of the tie between 20 inches and 40 inches from its middle.

4. Shake - Shake greater than one-third the width of the tie will be cause for rejection of the tie.

5. Split - A tie will be rejected if a split exceeds 5 inches long or 1/2 inch wide.

6. Slanting Grain - A tie will be rejected if a slant in grain in excess of 1:15 is present, except in the case of woods with interlocking grain.

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DATE: 10-28-92
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7. Wane - Excessive wane will be cause for rejection of the tie.

INSPECTION

Green ties will be inspected at the time of delivery to seasoning area. Dry ties will be subject to inspection after seasoning and before treatment.

Inspector will make a close examination of the top, bottom, sides and ends of each tie. Each tie will be graded independently without regard for the grading of the others in the same lot. Ties covered with ice, or too muddied for ready examination, will be rejected. The responsibility and expense for the inspection described above will be borne by the manufacturer.

When conditions warrant, in the judgment of the Chief Engineering Officer or his designee, ties will be inspected at other points, and all ties are subject to inspection at delivery.

Anti-splitting plates that are found to be loose or not firmly against the end of the tie will be cause for rejection of the tie.

SEASONING

Crossties shall be air seasoned prior to treatment. Ties shall be stacked for seasoning in accordance with AREA Specifications, Chapter 3, Part 5, Section 6. Seasoning shall continue for at least 12 months and no more than 18 months.

In the absence of air seasoned crossties, the Vapor or Boulton drying process may be used with the permission of the Chief Engineering Officer, or his designee. If the Vapor or Boulton process is used, conditioning should continue until moisture removal rate indicates a percent moisture retained equal to a 12 month air dried cross tie, but not less than 45 percent by weight.

Sufficient borer cores shall be taken of seasoned ties to determine that adequate drying has taken place so that ties may be satisfactorily penetrated with preservative.

Prior to seasoning, all crossties shall have anti-splitting devices applied at each end of the tie.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

CROSSTIE - TREATED

TREATMENT

Prior to treatment anti-splitting plates must be checked to ensure that plates are firmly imbedded in the tie. If plates are found to be loose or not flush against the end of the tie, plate shall be firmly pressed against the tie before treatment begins.

Crosstie treatment shall be to retention of seven pounds or to refusal of 60/40 creosote and petroleum per cubic foot of timber in accordance with the latest AREA Manual, Chapter 3, Parts 7, 8, & 9.

Sufficient number of borings shall be taken after treatment to determine proper penetration.

SUBMITTALS

Prior to shipment, the manufacturer shall submit certified inspection and test reports to the Chief Engineering Officer, or his designee, for review.

SHIPMENT

Ties shall be bundled in groups of 24 pieces, in a configuration of four rows of 6 on edge with two 2 inch by 0.05 inch heavy duty steel bands with two seals per band. Wood dunnage shall be placed on the bottom of the transportation vehicle and between tiers to facilitate unloading operations.

DELIVERY

To be accepted, the ties offered shall conform to this specification in all respects and are at the supplier's risk until acceptance at the specified delivery site. Ties which are rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1100

No. 1106

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

CUT TRACK SPIKE

MATERIALS

Cut track spikes shall conform to material and workmanship specifications of the AREA Manual for Railroad Engineering, Chapter 5, Part 2 - "Specifications for Soft-Steel Track Spikes".

DESIGN

Cut track spikes shall be in accordance with MBTA Book of Standard Plans.

INSPECTION

Inspection shall be in accordance with the inspection procedures outlined in AREA Manual Chapter 5, Part 2.

SHIPMENT

All cut track spikes shall be packed in sealed-top kegs or other suitable container, with a maximum of 200 pounds of non-defective cut track spikes per container.

DELIVERY

To be accepted, the cut track spikes offered shall conform to this specification in all respects. All spikes are subject to inspection at delivery and are at the supplier's risk until acceptance. All spikes rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1210

APPROVED: John D. Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

DERAIL - SPLIT SWITCH

MATERIALS

Materials shall conform to AREA-Portfolio of Trackwork Plans - Plan No. 100-89 "Specification for Special Trackwork".

DESIGN

Split switch derail shall be a 16'-6" switch point complete with 39 foot undercut stock rail, switch plates, rail braces, solid heel block, operating rod and support bracket, connecting rod, and switch stand in accordance with MBTA Standard Plans 3006 and 3007. Derail shall be for right or left hand as specified in the order.

Switch point and stock rail shall be manufactured from heat treated rail per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

MANUFACTURE

Split switch derail shall include, but not be limited to, the following components in accordance with MBTA Standard Plans specified by plan number.

16'-6" Switch Point

Heel Block Assembly

39'-0" Undercut Stock Rail

Adjustable Brace Plates

Switch Rail Stop

Adjustable Rocker Clip

Switch Rod

Turnout Plates

Rail Braces

New Century Switch Stand

Operating Rod Support Bracket

Screw Spikes

MATERIALS TO BE SUPPLIED BY OTHERS

Lock Spikes, Cut Track Spikes and Switch Timber

APPROVED: _____
ENGINEERING OFFICER

DATE: 10-28-92
_____
CHIEF ENGINEERING OFFICER

DERAIL - SPLIT SWITCH

SHIPMENT

Switch point and stock rail shall be blocked and banded together; switch rods shall be banded together; plates, braces and switch stands shall be palletized and wrapped or banded for shipment. All shall be marked to identify them as a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the split switch derail conform to this specification and the MBTA Standard Plans referenced herein.

DELIVERY

To be accepted switch point derail must conform to this specification in all respects. Switch point derail is subject to inspection at time of delivery and is at supplier's risk until accepted by the Authority. Switch point derail rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 2104	No. 2340	No. 3006
No. 2106	No. 2350	No. 3007
No. 2107	No. 2352	No. 3020

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

DERAIL - SPLIT SWITCH

MATERIALS

Materials shall conform to AREA-Portfolio of Trackwork Plans - Plan No. 100-89 "Specification for Special Trackwork".

DESIGN

Split switch derail shall be a 16'-6" switch point complete with 39 foot undercut stock rail, switch plates, rail braces, solid heel block, operating rod and support bracket, connecting rod, and switch stand in accordance with MBTA Standard Plans 3006 and 3007. Derail shall be for right or left hand as specified in the order.

Switch point and stock rail shall be manufactured from heat treated rail per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

MANUFACTURE

Split switch derail shall include, but not be limited to, the following components in accordance with MBTA Standard Plans specified by plan number.

16'-6" Switch Point

Heel Block Assembly

39'-0" Undercut Stock Rail

Adjustable Brace Plates

Switch Rail Stop

Adjustable Rocker Clip

Switch Rod

Turnout Plates

Rail Braces

New Century Switch Stand

Operating Rod Support Bracket

Screw Spikes

MATERIALS TO BE SUPPLIED BY OTHERS

Lock Spikes, Cut Track Spikes and Switch Timber

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

DERAIL - SPLIT SWITCH

SHIPMENT

Switch point and stock rail shall be blocked and banded together; switch rods shall be banded together; plates, braces and switch stands shall be palletized and wrapped or banded for shipment. All shall be marked to identify them as a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the split switch derail conform to this specification and the MBTA Standard Plans referenced herein.

DELIVERY

To be accepted switch point derail must conform to this specification in all respects. Switch point derail is subject to inspection at time of delivery and is at supplier's risk until accepted by the Authority. Switch point derail rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 2104	No. 2350
No. 2106	No. 2352
No. 2107	No. 3007
No. 2340	No. 3020

APPROVED: _____
ENGINEERING OFFICER

DATE: 10-28-92
_____
CHIEF ENGINEERING OFFICER

GEOTEXTILE FABRIC

MATERIAL

Geotextile fabric shall be manufactured from polypropylene or polyester petroleum-based polymers.

DESIGN

Geotextile fabric shall be manufactured in minimum 13 foot width in rolls 100, 200, or 300 feet long and shall have a minimum weight of 16 ounces per square yard. Length and width of rolls to be specified in the order.

MANUFACTURE

Geotextile fabric shall be needle punched, non-woven, continuous filament, non-thermal bonded cloth such as TREVIRA SPUNBOND 1155 as manufactured by Hoechst Celanese Corporation, or approved equivalent.

SUBMITTALS

Prior to delivery, the manufacturer shall submit certified statements that the geotextile fabric offered has mechanical and physical strength characteristics that meet or exceed the strength of TREVIRA SPUNBOND 1155.

SHIPMENT

Geotextile fabric shall be rolled around a strong tube and wrapped to protect from the elements of nature and handling, including ultraviolet deterioration.

DELIVERY

To be accepted, geotextile fabric offered shall conform to this specification in all respects. Geotextile fabric is subject to inspection at delivery and is at the supplier's risk until acceptance. Geotextile fabric rejected for non-compliance with this specification will be returned at the supplier's expense.

APPROVED: John D. Reg
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

INSULATED BONDED JOINT PLUG RAIL

MATERIALS

Insulated joints shall be in conformance with AREA Manual for Railway Engineering, Chapter 4, Part 2, "Specification for Quenched Carbon-Steel Joint Bars".

Rail shall be No. 1, fully heat-treated, high strength steel rail with no "A" rails. Rail shall conform to MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

DESIGN

The joint bars shall be 36 inch, full-face contact design, conforming to the rail section specified and shall consist of joint bars, end posts, bushings, bolts, nuts, washers and insulated polyplate tie plates (when specified on the order), as manufactured by Portec or equivalent.

Joint bars shall conform to rail size specified in the order.

MANUFACTURE

Rail shall be two pieces, with lengths as specified on the order, jointed to form a plug rail. Web of rail where joint is to be bonded shall be ground free of brandings to provide a full contact fit.

Joint Bars - Joint bars to be smooth and straight with all burrs removed. The inside face of the joint bars shall have all insulating material pre-bonded and shall be free of stamping or branding. The fabrication tolerances shall be as follows:

Fishing Height - Plus or minus 1/64 inch
Straightness - Plus or minus 1/32 inch in 36 inches
Length - Plus or minus 1/8 inch

Joint bars shall be designed so that when fully assembled and bonded to rail 3/4 of an inch of rail base, on each side of the rail, shall be exposed to allow application of rail fasteners.

Insulation - Insulation materials shall be of high pressure, laminated design, impervious to oil, grease and water. The material shall have electrical resistance characteristics equal to or greater than fiber insulation meeting the requirements of the AAR Manual, Part 116, Signal Section Specification 216-46.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

End posts shall be manufactured to fit ball, web, and base and shall be 3/16 inch thick and shall project 1/4 inch plus to 1/16 inch minus below the base of rail.

Fasteners - Insulated bonded joints shall be bolted together with six high strength 1 inch bolts. The bolts shall be in conformance with ASTM Specification A490 having Class 2A and 2B thread fit. The fastener provided must provide a positive means for maintaining the tension in the bolts by a lock-nut complying with Industrial Fastener Institute Standard IFI-100 and IFI-101, or approved equivalent. Flat washers, if required, shall be hardened A-325 or A-490 quenched and tempered carbon steel.

Adhesive - The adhesive shall have a shelf life of at least one year when stored in a protected, weather tight location at reasonable storage temperatures, and shall withstand the requirements of the prescribed mechanical testing.

TESTING

The manufacturer shall perform and certify in writing prior to shipment, that three assembled joints, representative of the joints offered, have successfully passed the following tests:

Rolling Load Test
Longitudinal Compressive Strength

Rolling Load Test - The rail joint shall be mounted on a 33 inch stroke rolling load test machine, supported on 36 inch centers, with the joint centered between the supports. Apply a 44,400 pound wheel load on the rail for 2,000,000 cycles and measure and record to the nearest 0.001 inch the deflection of the rail at the centerline of the joint. The deflection at the ends of the joint shall also be measured at every 500,000 cycles. The wheel path shall travel from a point 6 inches from the center of the joint to a point 9 inches outside the opposite end of the joint. Total range of deflection of the joint shall not exceed 0.065 inches during the test and the joint shall show no evidence of failure by bending. The electrical resistance test shall then be performed and the test results shall be within the acceptance criteria specified.

The Longitudinal Compression Test shall then be performed on the test specimens and the results shall be within the acceptance criteria specified.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

Longitudinal Compression Test - The assembled joint shall be sawn in half where the rails are joined together in a manner which will prevent over-heating and damage to the epoxy bond. The cut shall be perpendicular to the center line of the top of rail.

A fixture or device shall be used so that the reaction at the sawn ends occurs only on the face of the joint bars when a load is applied to the centroid of the rail at the opposite end. The load shall be applied in increments of 25,000 pounds, maintaining each load increment until the deflection of the rail stops before increasing the load. The load shall be increased to 650,000 pounds and a record of loading and differential movement of the rail, measured to 0.001 inch shall be measured for each increment. The joint shall show no indication of slippage prior to reaching a compressive load of 650,000 pounds and the movement shall be less than 1/8 inch in any direction. The relative position of the rail and joint bar shall be within 1/32 inch of its original value when the load is removed.

The manufacturer shall perform and certify in writing, prior to shipment, that each assembled INSULATED BONDED JOINT PLUG RAIL, in the order, has successfully passed the following Electrical Resistance Test.

Electrical Resistance Test - A rail joint shall be assembled in accordance with manufacturer's recommendations and supported on non-conducting material. With 500 volts dc applied to the rail across the bonded insulated joint for a duration of three minutes, the current flow through the joint should be measured to the nearest 0.1 micro ampere. The minimum acceptable resistance for the test shall be 10 megohms. With 50 volts ac applied to the rail across the bonded insulated joint for a duration of three minutes, the impedance shall be measured with an accuracy of plus or minus 2 degrees. This test shall be repeated three times, once with a frequency in the range from 10Hz to 100Hz, again with a frequency in the range from 200Hz to 1000Hz and again in the range from 2000Hz to 10KHz. The minimum acceptable impedance for any of these tests shall be 10,000 ohms.

Allegheny

APPROVED:

ENGINEERING OFFICER

DATE: 10-28-92

CHIEF ENGINEERING OFFICER

INSULATED BONDED JOINT PLUG RAIL

FABRICATION

All insulated bonded joint plug rails shall be fully shop assembled prior to shipment.

Insulated bonded joint plug rails shall be in accordance with MBTA Standard Plan to lengths as specified in the order.

SUBMITTALS

Prior to shipment, the manufacturer shall submit shop drawing showing materials and fabrication tolerances.

Prior to shipment, the manufacturer shall submit certified test results for tests described under testing.

All submittals shall be made to the Chief Engineering Officer, or his designee, for review.

DELIVERY

To be accepted, insulated bonded joint plug rails shall conform to this specification in all respects. Insulated bonded joint plug rails are subject to inspection at delivery and are at the supplier's risk until acceptance. Insulated bonded joint plug rails rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1340

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

INSULATED JOINT KIT

MATERIALS

Insulated joint bars shall be manufactured to conform to AREA Manual for Railway Engineering, Chapter 4, Part 2, "Specifications for Quenched Carbon-Steel Joint Bars".

DESIGN

Insulated joint shall be 36 inch, 6 hole, short toe, full face design, conforming to the configuration of the rail section ordered, bars shall be insulated with a polymeric material.

Joint shall consist of joint bars, bolts, nuts and washers, end posts, and bushings packaged as a unit.

Joint shall conform to rail size specified in the order.

End posts shall be 3/16 inch thick and shall project 1/4 inch plus to 1/16 inch minus below the base of the rail.

SUBMITTAL

Prior to fabrication, the manufacturer shall submit shop drawings showing details of materials, manufacturing procedures, and tolerances to the Chief Engineering Officer, or his designee, for review.

Upon completion of the testing, submit certified results in writing including statement that joints have passed the test and are approved.

MANUFACTURE

Joint bars shall be smooth and straight with all burrs removed. The bars shall be short toe type so that when the joint is completely assembled 3/4 of an inch of rail base, on both sides of the rail, shall be exposed to allow application of rail fasteners. The face of the joint bar shall be free of stamping or branding. Boring of bolt holes shall be for 1 1/8 inch bolts spaced as shown on MBTA STANDARD PLAN for rail section ordered.

APPROVED: John D. Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

INSULATED JOINT KIT

Insulation shall be a uniform, single pour, polymetric insulation material, equivalent to that manufactured by Portec, Inc. Joint insulation, end post and bushing insulation material shall be impervious to oil, grease and water, and shall have electrical resistance characteristics equal to or greater than fiber insulation meeting the requirements of the AAR Signal Manual Part 14.5.1. Insulated joints shall be highly resistant to abrading, cracking, cutting, spalling and fatigue failure under impact loads, and shall exhibit deflection characteristics comparable to standard steel rail joints.

Fasteners - insulated joint kits shall be supplied with six high strength 1 1/8 inch bolts. The bolts shall be in conformance with ASTM Specification A490 having Class 2A and 2B thread fit. The fastener provided must provide a positive means for maintaining the tension in the bolts by a lock-nut complying with Industrial Fastener Institute Standard IFI-100 and IFI-101, or approved equivalent. Flat washers, if required shall be hardened A325 or A490 quenched and tempered carbon steel.

TESTING

The manufacturer shall perform and certify in writing, prior to shipment, that three assembled joints have successfully passed the following tests:

Electrical Resistance Test
Rolling Load Test

Electrical Resistance Test - A rail joint shall be assembled in accordance with manufacturer's recommendations and supported on non-conducting material. With 500 volts dc applied to the rail across the insulated joint for a duration of three minutes, the current flow through the joint should be measured to the nearest 0.1 micro ampere. The minimum acceptable resistance for the test shall be 10 megohms. With 50 volts dc applied to the rail across the insulated joint for a duration of three minutes, the impedance shall be measured with an accuracy of plus or minus 2 percent. This test shall be repeated three times, once with a frequency in the range from 20Hz to 100Hz, again with a frequency in the range from 200Hz to 1000Hz and again in the range from 2000Hz to 10KHz. The minimum acceptable impedance for any of these tests shall be 10,000 ohms.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

INSULATED JOINT KIT

Rolling Load Test - The rail joint used in the Electrical Resistance Test shall be fully assembled onto two pieces of rail, each a minimum of 30 inches in length, and mounted on a 33 inch stroke rolling load test machine, supported on 36 inch centers, with the joint centered between the supports. Apply a 44,400 pound wheel load on the rail for 2,000,000 cycles and measure and record to the nearest 0.001 inch the deflection of the rail at the centerline of the joint. The deflection at the ends of the joint shall also be measured at every 500,000 cycles. The wheel path shall travel from a point 6 inches from the center of the joint to a point 9 in. outside the opposite end of the joint. Total range of deflection of the joint shall not exceed 0.065 inches during the test and the joint shall show no evidence of failure by bending. The electrical resistance test shall then be repeated and the test results shall be within the acceptance criteria specified.

SHIPMENT

Insulated joint shall be packaged in kit form with each kit containing all necessary materials and instructions to install the joint.

DELIVERY

To be accepted, insulated joint kits shall conform to this specification in all respects. Insulated joint kits are subject to inspection at delivery and are at the supplier's risk until acceptance. Insulated joint kits rejected for non-compliance with this specification will be returned at the supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

JOINT BARS & FASTENINGS

MATERIAL AND MANUFACTURE

Standard joint bar material and manufacture shall be in accordance with AREA Manual for Railway Engineering, Chapter 4, Part 2 - Specifications for "Quenched Carbon-Steel Joint Bars and Forged Compromise Joint Bars."

Track bolts and nuts material and manufacture shall be in accordance with AREA Manual, Chapter 4, Part 2, "Specifications for Heat-Treated Carbon-Steel Track Bolts and Carbon-Steel Nuts."

1. Prior to shipment entire bolt thread shall be coated with an approved oil or grease to protect threads.

2. Bolt and nut shall be assembled by turning nut onto bolt at least 2 threads.

Lockwashers material and manufacture shall be in accordance with AREA Manual, Chapter 4, Part 2, "Specifications for Spring Washers."

DESIGN

Joint bars shall be in accordance with MBTA Standard Plans for 115 lb. and 132 lb. rail as specified in the order. All other rail section joint bars shall conform to AREA Manual, Chapter 4, Part 1 with length and punching as specified in the order.

Compromise joints shall be in accordance with MBTA Standard Plans for rail sizes as specified in the order.

Track bolts shall be rolled, button-head, elliptic-neck bolts with wrench fit thread and shall be provided with standard square nuts all per AREA Manual Chapter 4, Part 1. Bolt diameter and length shall be as specified in the order.

Lock washer diameter shall be as specified in the order and washer configuration shall conform to requirements of ANSI, B27.1, for "Extra Heavy Duty Helical Spring Lock Washers."

INSPECTION

Inspection and testing shall be in conformance with the inspection procedures outlined in AREA Manual, Chapter 4, part 2.

Prior to shipment, the manufacturer or supplier shall submit certified inspection and test reports.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

JOINT BARS & FASTENINGS

Joints, bolts and nuts, and lock washers are subject to inspection at delivery and are at suppliers risk until accepted by the Authority.

DELIVERY

Joints shall be wired into pairs, palletized and strapped for shipment.

Bolts and nuts shall be packed in sealed kegs with a maximum of 200 pounds per keg. Kegs shall be palletized and wrapped or strapped for shipment.

Lock washers shall be packed in steel pails or kegs with a maximum of 200 pounds per container.

Material rejected because of non-conformance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 1320

No. 1322

No. 1328

APPROVED:

ENGINEERING OFFICER

DATE: 10-28-92

CHIEF ENGINEERING OFFICER

LOCKSPIKE

MATERIALS

Lockspikes shall be manufactured from a high grade alloy spring steel.

MANUFACTURE

Lockspike shall be 5/8 inch by 7 inches and shall be in accordance with MBTA Standard Plan and shall be heated, formed, and quenched to produce a minimum tensile strength of 160,000 psi and elongation of 2.5 percent.

INSPECTION

Lockspikes are subject to inspection at time of delivery for compliance with these specifications.

SHIPMENT

Lockspikes shall be in sealed-top kegs or crates with a maximum of 200 pounds of non-defective lockspikes per container. Containers shall be stacked on pallets, no more than 2 kegs or crates high, and wrapped or strapped.

DELIVERY

To be accepted, lockspikes shall conform to these specifications. Lockspikes are subject to inspection at time of delivery and are at supplier's risk until accepted. Lockspikes rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1216

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RAIL-HIGH STRENGTH RUNNING

LENGTH

High strength running rail shall be supplied in 39 foot; 78 foot; or 80 foot lengths as specified in the order.

Short rails, in lengths as follows, shall be accepted up to the percent of the total order as specified in the order. If no percentage is specified then no short rails will be accepted.

Rail Length Ordered	Acceptable Short Lengths
39 foot	30 to 38 feet
78 foot	60 to 76 feet
80 foot	60 to 78 feet

MATERIAL

High strength running rail shall be new, control cooled, fully-heat-treated, steel rails of the weight specified in the order.

Chemical Composition of high strength rail shall conform to AREA Chapter 4, Part 2, Section 3.

Hardness of high strength rail shall conform to AREA Chapter 4, Part 2, Section 4.

MANUFACTURE

High strength running rail shall be in accordance with AREA Chapter 4, Part 2.

High strength running rail shall be fully-heat-treated, oil quenched, and tempered in accordance with AREA Chapter 4-M-7 or approved equivalent.

INSPECTION

Rail shall be ultrasonicly inspected along its full length for rail flaws.

The manufacturer or supplier of new high strength running rail shall be responsible for all tests and inspections necessary to ensure that rail is in accordance with these specifications.

The following AREA forms from Chapter 4, Part 3 shall be completely and correctly filled in and delivered to the Authority prior to receipt of the rails.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RAIL-HIGH STRENGTH RUNNING

No. 401 - A Report of Chemical and Physical Inspection of Rails - 1961.

No. 401 - B Certificate of Inspection - 1961

No. 401 - C Report of Shipment - 1961

No. 401 - D Record of Control Cooled Rails - 1961

Manufacturer shall supply copies of heat-treating records and records of the Brinell Hardness achieved.

In addition to the above, all rails are subject to inspection by the Authority or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that all rail meets the requirement of this specification.

The manufacturer may have a representative present during this inspection.

High strength running rail is at the risk of the manufacturer or supplier until accepted by the Authority.

The Authority reserves the right to inspect the rail during manufacture or prior to shipment.

SHIPMENT

Rail shall be shipped in open railroad flat cars or gondolas.

Rail shall be loaded head-up with the rail bases touching.

First tier shall be set on blocking with three (3) blocks per 39 foot rail and five (5) blocks per 78 or 80 foot rail. Each subsequent tier shall be blocked in the same manner. Blocking used shall be of sufficient strength to support rail without crushing.

Rails shall be properly banded and secured to the car to prevent movement.

Short rails, when accepted in the order, shall be loaded separately - do not mix full lengths and shorts in the same car.

Rail rejected because of non-compliance with this specification will be returned at supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RAIL-STANDARD RUNNING

LENGTH

Standard running rail shall be supplied in 39 foot; 78 foot; or 80 foot lengths as specified in the order.

Short rails, in lengths as follows, shall be accepted up to the percent of the total order as specified in the order. If no percentage is specified then no short rails will be accepted.

Rail Length Ordered	Acceptable Short Lengths
39 foot	30 to 38 feet
78 foot	60 to 76 feet
80 foot	60 to 78 feet

MATERIAL

Standard running rail shall be new, control cooled steel rails of the weight specified in the order.

Chemical composition of standard rail shall conform to AREA Chapter 4, Part 2, Section 3.

Hardness of standard rail shall conform to AREA Chapter 4, Part 2, Section 4.

MANUFACTURE

Standard running rail workmanship shall be in accordance with AREA Chapter 4, Part 2.

INSPECTION

Rail shall be ultrasonicly inspected along its full length for rail flaws.

The manufacturer or supplier of new standard running rail shall be responsible for all tests and inspections necessary to ensure that rail is in conformance with these specifications.

The following AREA forms from Chapter 4, Part 3 shall be completely and correctly filled in and delivered to the Authority prior to receipt of the rail.

No. 401 - A Report of Chemical and Physical Inspection of Rails - 1961.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RAIL-STANDARD RUNNING

No. 401 - B Certificate of Inspection - 1961

No. 401 - C Report of Shipment - 1961

No. 401 - D Record of Control Cooled Rails - 1961

In addition to the above, all rails are subject to inspection by the Authority or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that all rail meets the requirement of this specification.

The manufacturer may have a representative present during this inspection.

Standard running rail is at the risk of the manufacturer or supplier until accepted by the Authority.

The Authority reserves the right to inspect the rail during manufacture or prior to shipment.

SHIPMENT

Rail shall be shipped in open railroad flat cars or gondolas.

Rail shall be loaded head-up with the rail bases touching.

First tier shall be set on blocking with three (3) blocks per 39 foot rail and five (5) blocks per 78 or 80 foot rail. Each subsequent tier shall be blocked in the same manner. Blocking used shall be of sufficient strength to support rail without crushing.

Rails shall be properly banded and secured to the car to prevent movement.

Short rails, when accepted in the order, shall be loaded separately - do not mix full lengths and shorts in the same car.

Rail rejected because of non-compliance with this specification will be returned at supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RAIL ANCHOR-DRIVE ON TYPE

SIZE

Anchors shall be for rail weight specified in the order.

MATERIALS

Drive-on type rail anchors shall be manufactured from heat-treated steel and shall conform to AREA Manual, Chapter 5, Part 7.

MANUFACTURE

Drive-on type rail anchors shall be one piece, heavy duty type, such as Channeloc anchors, or approved equivalent designed to be fastened to the rail base and exert anti-creepage force against the edge of tie to resist rail movement. Drive-on type rail anchors shall be manufactured as specified in AREA Manual Chapter 5, Part 7 to allow both mechanized and manual application and shall be capable of removal and reapplication without appreciable loss of anchoring capability. Each drive-on type rail anchor shall be stamped to indicate the rail section for which it is designed and the year of manufacture.

TESTING

The manufacturer shall perform tests specified in AREA Manual Chapter 5, Part 7 and certify in writing prior to shipment, that representative samples of the anchors offered have met or exceeded the specified tests.

SUBMITTALS

Prior to shipment, the manufacturer shall submit certified test results as described above.

SHIPMENT

Drive-on type rail anchors shall be packed 50 anchors per bag in heavy canvas or other suitable bags and waterproof tags applied. Tags shall be marked with style and base of rail of anchor design.

DELIVERY

To be accepted, drive-on type rail anchors offered shall conform to this specification in all respects. Drive-on type rail anchors are subject to inspection at delivery and are at the supplier's risk until acceptance. Drive-on type anchors rejected for non-compliance with this specification shall be returned at the supplier's expense.

APPROVED: _____
ENGINEERING OFFICER

DATE: 10-28-92
_____
CHIEF ENGINEERING OFFICER

RAIL ANCHOR - SPRING TYPE

SIZE

Anchors shall be for rail weight specified in the order.

MATERIALS

Spring type rail anchors shall be manufactured from heat-treated steel and shall conform to AREA Manual, Chapter 5, Part 7.

MANUFACTURE

Spring type rail anchors shall be one piece, heavy duty type, similar to Trueloc or Unit anchors, or approved equivalent, designed to be fastened to the rail base and to exert anti-creepage force against the edge of tie to resist rail movement. Spring type rail anchors shall be manufactured as specified in AREA Manual Chapter 5, Part 7 to allow both mechanized and manual application and shall be capable of removal and reapplication without appreciable loss of anchoring capability. Each spring type rail anchor shall be stamped to indicate the rail section for which it is designed and the year of manufacture.

TESTING

The manufacturer shall perform tests specified in AREA Manual, Chapter 5, Part 7 and shall certify in writing prior to shipment, that representative samples of the anchors offered have met or exceeded the specified tests.

SUBMITTALS

Prior to shipment, the manufacturer shall submit certified test results as described above.

SHIPMENT

Spring type rail anchors shall be packed 50 anchors per bag in heavy canvas or other suitable bags and waterproof tags applied. Tags shall be marked with style and base of rail of anchor design.

DELIVERY

To be accepted, spring type rail anchors offered shall conform to this specification in all respects. Spring type rail anchors are subject to inspection at delivery and are at the supplier's risk until acceptance. Spring type anchors rejected for non-compliance with this specification shall be returned at the supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RESILIENT FASTENER

MATERIAL

Resilient fastener shall be manufactured from high quality spring steel bar stock.

DESIGN & MANUFACTURE

Resilient fastener shall be designed and manufactured to fit MBTA Standard Resilient Fastener Tie Plate for rail weight as specified in the order.

Resilient fastener shall be designed to resist rail longitudinal forces by exerting downward pressure on the base of the rail by spring action.

Resilient fastener shall be designed to be installed by driving with hand tools or applied mechanically by an on-track machine.

Resilient fastener shall be designed so that application pressure shall be by driving parallel to length of rail to avoid possible damage to rail base by scoring.

Resilient fastener shall have a minimum hold down force of 2750 pounds for each fastener.

Minimum static longitudal slip per complete rail fastener assembly with two resilient fasteners in place shall be 5500 pounds.

Resilient fastener shall be designed to be installed and removed by one man using readily available track tools or by commercially available equipment and shall be capable of removal and reapplication without appreciable loss of hold down force.

TESTING

Representative samples from each run of resilient fasteners shall be tested and certified that they meet this specification in all respects.

SUBMITTAL

Submit results of testing and certification that resilient fasteners meet or exceed this specification.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

RESILIENT FASTENER

SHIPMENT

Resilient fasteners shall be packed 50 fasteners per bag in heavy canvas or other suitable bags and have waterproof tags attached identifying the manufacturer and the order number.

DELIVERY

To be accepted resilient fasteners shall conform to this specification in all respects. Fasteners are subject to inspection at time of delivery and are at manufacturer's or supplier's risk until accepted. Fasteners rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 1224

No. 1225

APPROVED:

ENGINEERING OFFICER

DATE: 10-28-92

CHIEF ENGINEERING OFFICER

SCREW SPIKES

MATERIALS

Screw spikes shall be hot forged from medium carbon steel conforming with ASTM designation A-66.

DESIGNS

Screw spikes shall be in accordance with MBTA Book of Standard Plans.

Screw spikes shall be either 7/8 inch by 5 3/4 inches measured under the head or 15/16 inch by 6 inches measured under the head as specified on the order.

Screw spikes shall be manufactured to comply with ASTM A-66 to meet the following physical requirements.

Tensile Strength - Minimum psi 60,000
Yield Point - psi 0.5 tensile strength
Elongation - 18 percent in 2 inches
Heads shall be "S" style

INSPECTION

Inspection shall be in accordance with the inspection procedures outlined in AREA Manual.

SHIPMENT

Screw spikes shall be packed in sealed-top kegs or other suitable containers, with a maximum of 200 pounds of non-defective lags per container.

DELIVERY

To be accepted, screw spikes offered shall conform to this specification in all respects. Screw spikes are subject to inspection at delivery and are at supplier's risk until acceptance. Screw spikes rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 1218

APPROVED: John D. Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

STONE BALLAST

SIZE

Ballast shall conform to AREA Size No. 4 per AREA Chapter 1, Part 2, Table No. 3 as modified by these specifications.

MATERIAL

Ballast shall be crushed, quarried, washed stone conforming to the current AREA Specification Chapter 1, Section 2 and the following:

Ballast Quality Requirements:

1. Deleterious Substances. The amount of deleterious substances present in prepared ballast shall not exceed the following limits, when using test methods specified herein.

	Percent By Weight	Method of Test
Soft and Friable Pieces	3.0	ASTM C235
Material Finer Than No. 200 Sieve	0.5	ASTM C117
Clay Lumps	0.5	ASTM C142

2. Flat or elongated particles having a length equal to or greater than five times the average thickness of the particle shall not exceed five percent by weight of the total when visually inspected.

3. Water absorption shall not exceed 0.4 pounds per cubic foot when tested in accordance with ASTM C127.

4. Percentage of wear, when tested in the Los Angeles abrasion machine in accordance with ASTM C535, grading No. 2, shall not exceed 18 percent.

5. Soundness of the prepared ballast shall be such that when tested in the sodium sulphate soundness test in accordance with ASTM C88, weighted average loss shall not exceed 1.5 percent after 10 cycles of test.

APPROVED: John D Roy
ENGINEERING OFFICER

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6. Cementing value of the ballast shall not exceed an average value of 320 pounds per square inch for five specimens when tested in accordance with the Logan Walter Page Method (U.S. Department of Agriculture, Bulletin No. 347, 1916, Pg. 15) except as modified as follows:

   1. A sufficient amount of pea size pieces of the rock, amounting to about 500 grams (1.1 pounds) is revolved in Los Angeles Abrasion Cylinder with three cast iron balls 4.76 cm. (1.875 inch) diameter and weighing approximately 0.43 kilograms (0.95 pounds) at the rate of 30 and 33 revolutions per minute, and the stiff dough at room temperature resulting from about 500 grams (17.64 oz.) of dust screened through a 100 mesh sieve, mixed with sufficient water, thoroughly kneaded for five minutes, allowed to stand in an air tight container for two hours, is molded into cylindrical briquettes 2.54 cm. (1 inch) diameter by 2.54 cm. (1 inch) in height under a pressure of 132 Kgs. per sq. cm. (1877.5 pounds per square inch), after which they are dried for 20 hours in air at room temperature, 4 hours in a hot air bath at a temperature of 100 degrees C (212 degrees F), then cooled for 20 minutes in a desiccator and immediately tested in a compression testing machine for static crushing strength, the bearing heads being suspended by pivots to secure uniform distribution of load, which is applied at 600 pounds per minute, approximately.

7. Determine ballast weight per cubic foot in accordance with ASTM C29.

8. Ballast samples shall be obtained in accordance with ASTM D75.

HANDLING

1. Shipping

   Load ballast only into rail cars or trucks which are in good order, tight enough to prevent leakage and waste of material, and clean and free from rubbish or any substance which would foul the ballast.

2. Handling

   a. Handle prepared ballast at production plant, during shipment, and at work site so that it is kept clean and free from segregation.

APPROVED: John D Roy
ENGINEERING OFFICER

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b. Do not make repeated passes of equipment over the same level in stock pile area.

DELIVERY

To be accepted, stone ballast offered shall conform to this specification in all respects. Stone ballast is subject to inspection at delivery and is at the supplier's risk until acceptance. Stone ballast rejected for non-compliance with this specification will be returned at the supplier's expense.

APPROVED:

ENGINEERING OFFICER

DATE: 10-28-92

CHIEF ENGINEERING OFFICER

SUB-BALLAST

MATERIALS

Sub-ballast shall be crushed stone or granulated, expanded or air-cooled slag with an average hardness of 5.5 minimum on Moh's Scale of Hardness.

Sub-ballast shall be composed of clean, hard, uncoated particles free from lumps of clay, shale and other objectional materials.

GRADATION

Gradation shall be in accordance with ASTM C136 and C117 as follows:

Sieve Size	Percent Passing by Weight
1 inch	100
3/8 inch	50 to 85
No. 4	35 to 65
No. 10	25 to 50
No. 40	15 to 25
No. 200	4 to 10

The fraction passing the No. 200 sieve shall be less than two-thirds of the fraction passing the No. 40 sieve.

1. Soft Particles: ASTM C235. 5 percent of sample weight maximum.

2. Clay lumps and friable particles: ASTM C142. 0.5 percent maximum.

3. Wear ASTM C131. 20 percent maximum.

4. Absorption: ASTM C127. 0.5 percent maximum.

Crushing of sub-ballast shall not be required except the supplier may, at his option, elect to crush any oversize particles present in the deposit as an alternative to screening.

PRODUCTION

Notify the Authority, at least 30 days prior to delivery, of the source and location of the source of materials to be used in order that approval test may be made.

APPROVED: John D. Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SUB-BALLAST

Use only the one approved material to complete order. Do not change source of material unless new source and material is approved, in writing, by the Authority.

Sub-ballast shall be handled during all stages of production and delivery in a manner that will provide all uniform product and will prevent contamination or segregation.

To satisfy the requirements of this specification sub-ballast may be screened, crushed, washed or otherwise processed to produce a uniform acceptable product.

Blending of materials to improve quality shall not be permitted.

HANDLING

1. Shipping

   Load sub-ballast only into rail cars or trucks which are in good order, tight enough to prevent leakage and waste of material, and clean and free from rubbish or any substance which would foul the sub-ballast material.

2. Handling

   a. Handle prepared sub-ballast at production plant, during shipment, and at work site so that it is kept clean and free from segregation.

   b. Do not make repeated passes of equipment over the same level in stock pile area.

DELIVERY

To be accepted, sub-ballast offered shall conform to this specification in all respects. Sub-ballast is subject to inspection at delivery and is at the supplier's risk until acceptance. Sub-ballast rejected for non-compliance with this specification will be returned at the supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SUPERELEVATION TAG

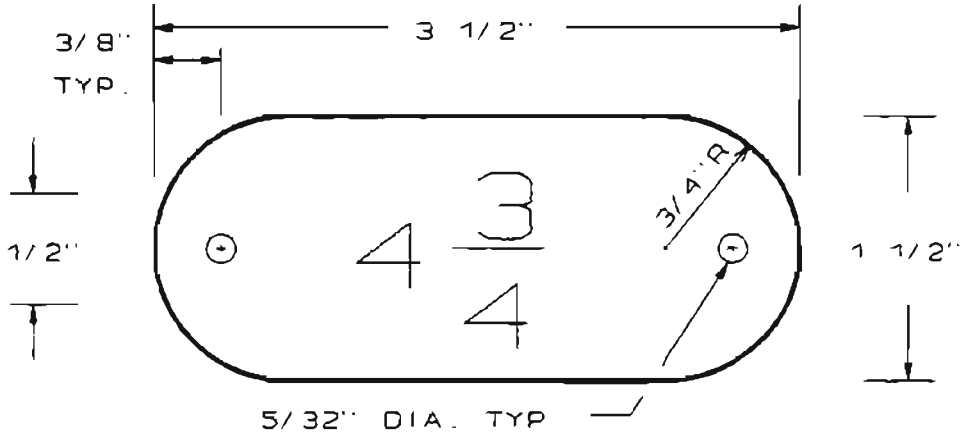
MATERIALS

Superelevation tags shall be 22 gage stainless steel, AISI Type 302 with unpolished finish No. 4.

Nails shall be fluted, galvanized steel nails.

DESIGN

Superelevation tag shall be 1½ inches x 3½ inches as shown:



Tags shall be stamped with embossed gothic figures and fractions specified in the order.

All numerals shall be 1/2 inch in height.

Nails shall be 1/8 inch x 1½ inch with flat head. Supply 3 nails for each tag ordered.

SHIPMENT

Tags shall be grouped by markings and wired together; nails shall be in boxes or kegs depending on quantity ordered.

DELIVERY

To be accepted, superelevation tags and nails shall conform to this specification. Tags and nails are subject to inspection at time of delivery and are at supplier's risk until acceptance. Tags and nails rejected because of non-compliance with this specification will be returned at supplier's expense.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SWITCH STAND

MATERIALS & WORKMANSHIP

Switch stand materials and workmanship shall conform to the current AREA Portfolio of Trackwork Plans, Plan No. 100-89-Specifications for Special Trackwork and Plan No. 251-64-Switch Stands and Appurtenances.

DESIGN

Switch stand shall be in accordance with MBTA Book of Standard Plans as specified on the order and shall be:

Low Stand	-	New Century Model A
	-	Racor Style 22
High Stand	-	New Century Model B

Operating rod shall be provided in length specified on the order.

Switch stand target in accordance with MBTA Standard Plan shall be provided if specified in the order.

INSPECTION

Manufacturer shall be responsible for inspections necessary to ensure mechanism conforms to this specification. Switch stand is subject to inspection at time of delivery.

SHIPMENT

Switch stand shall be shipped strapped to a pallet complete with operating rod and switch targets if so ordered.

DELIVERY

To be accepted switch stand must conform to this specification in all respects. Switch stand is subject to inspection at time of delivery and is at supplier's risk until accepted by the Authority. Switch stand rejected for non-compliance with this specification will be returned at supplier's expense.

APPLICABLE STANDARD PLANS

No. 3020-1	No. 3023
No. 3020-2	No. 3030

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TROPICAL HARDWOOD

MATERIAL

Switch timber shall be manufactured from natural tropical hardwood. Common names: Azobe, Ekki or Bongossi. Botanical name: Lophira Alata.

DESIGN

Switch timbers, except headblock timbers, shall be 7 inches x 9 inches in cross section x designated even foot increments. Headblock timbers shall be 9 inches by 10 inches in cross section and in lengths of 12, 13, or 16 feet as specified in the order.

Switch timbers shall be full-cut to actual dimensions with tolerances of one-half inch over and zero inch under in thickness and width, and four inches over and zero inches under in length. Switch timbers with dimensions exceeding these tolerances, at any point, will be rejected.

MANUFACTURE

Switch timber shall be manufactured from sound live natural tropical hardwood timber and must be free from any defects that may impair their strength or durability as switch timber.

Switch timbers shall be second cut, first quality, untreated, fresh-cut with approximately 40 percent moisture content.

Switch timbers shall be straight, sawn on four sides, cut square at the ends. Top and bottom shall be parallel and timbers shall be free of excessive bending or twisting as defined under QUALITY.

Timbers shall be cut without bark, wane or sapwood, but intermediate light-colored heartwood shall be permitted.

Anti-splitting banding device, approved by the Authority, may be applied at each end of a switch timber to ensure a quality timber acceptable to the Authority. Selection of switch timbers for installation of the banding device shall be the responsibility of the supplier. Banding device installed must remain on switch timber for timber to be accepted by the Authority. Headblock timbers for use in power turnouts shall be framed and have anti-splitting device installed as shown on MBTA Standard Plan.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TROPICAL HARDWOOD

QUALITY

Switch timbers shall be free from "white rot" and other defects.

Small drying splits, cracks or seasoning checks which do not impair the fastening or strength of the material shall be permitted.

Tropical hardwood switch timbers shall be in accordance with the following requirements:

- A timber will be considered straight when a straight line along the top from the middle of one end to the middle of the other end is not closer than 3 inches from either side of the tie, and when a straight line along a side from the middle of one end to the middle of the other end is everywhere more than 3 inches from the top and bottom of the tie.

- Decay - Timbers that show decay of any type and timbers that show stain due to delay in processing the log will be rejected. "Blue stain" shall not be considered decay and will be permissible.

- Holes - Timbers with holes form natural defects will be rejected unless approved by the Authority.

- Knots - Timbers shall be without knots.

- Shake - Timbers containing a shake more than 1/8 inch wide or length of more than 1/3 the width of the timber and within 1 inch of any face will be rejected.

- Split - Timbers containing an end split 3 inches or more in length will be rejected.

- Slanting Grain and Cross Grain - Timbers shall be straight grained. Maximum slope of grain shall be 1:10. Timbers will not be accepted with excessive cross grain.

- Wane - Wane or included bark shall not be permitted.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TROPICAL HARDWOOD

INSPECTION

Tropical hardwood switch timbers shall be inspected by a qualified independent inspection agency (the Inspector) approved by the Authority. Responsibility and expense for inspection shall be borne by the supplier.

Any timber containing a manufacturing defect may be rejected by the Inspector or by the Authority.

Switch timbers shall be inspected at point of receipt by the Inspector. Each timber shall be individually inspected for soundness, dimensional correctness, straightness and freedom from wane, excessive splits, twist, and rot.

Inspector shall make a close examination of the top, sides, ends and bottom of each timber. Each timber shall be graded independently, without regard for the grading of others. Grading tolerances, as specified herein, shall be applied during inspection. Timbers covered with ice or too muddied or too covered with debris for ready examination will be rejected.

To be accepted, switch timbers offered shall conform to this specification. Timbers are at the supplier's risk until acceptance by the Authority. Switch timbers which are rejected for non-compliance with this specification will be returned at the supplier's expense.

Switch timbers are subject to inspection by the Engineer.

SEASONING

Switch timbers shall be sufficiently air seasoned, as determined by the manufacturer, to meet all requirements of this specification.

TREATMENT

Switch timbers shall not be treated. Tropical hardwood timbers shall be naturally resistant to decay, insects, and fire without the use of chemical treatments or preservatives of any kind.

APPROVED: _____ DATE: 10-28-92

ENGINEERING OFFICER

CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TROPICAL HARDWOOD

MECHANICAL PROPERTIES

Tropical hardwood switch timbers shall have the following properties:

Maximum unit weight assumed for design purposes:	72 pcf
Brinell Hardness	50 - 58
Modulus of Elasticity (E)	2,490,000 psi

Allowable Stresses

Bending (F_b)	3,750 psi
Tension (F_t)	3,450 psi
Compression parallel to grain (F_c)	3,550 psi
Compression perpendicular to grain (F_c)	2,000 psi
Shearing parallel to grain (F_v)	450 psi

FIRE RESISTANCE

Tropical hardwood timbers shall be naturally resistant to fire without the use of chemical treatments or preservatives of any kind. Materials shall have a Class 1 flammability rating in tests performed in accordance with ASTM E -84-86, "Standard Test Method for Surface Burning Characteristics of Building Materials" which is similar to UL-723, ANSI No. 2.5, NEPA No. 255 and UBC 42-1.

CERTIFICATION

Tropical hardwood switch timbers shall be accepted only when accompanied by a certificate issued by the government of country-of-origin attesting to the fact that round logs, from which timbers are sawn, were obtained under government controlled conditions. Certificate shall state existence of national forestry laws and regulations governing administration of the forests and inspection of the felling areas including limitations on the felling of hardwood tress.

SUBMITTAL

After the inspection of each production group or shipment of hardwood switch timbers, the manufacturer or vendor shall submit certified inspection reports and copies of any test reports prepared to the Authority's Chief Engineering Officer, or his designee, for review.

APPROVED: John D Roy
ENGINEERING OFFICER

DATE: 10-28-92
CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TROPICAL HARDWOOD

SHIPMENT

Switch timbers shall be banded by size for shipment into a seaworthy bundle not exceeding 5,000 pounds. Wood strips shall be provided in each bundle of timbers to allow uniform air flow.

Wood dunnage shall be placed on the bottom of the transportation vehicle and between tiers to facilitate unloading operations.

Bindings for the timbers shall be of sufficient strength to facilitate multiple loading, unloading and handling with cranes and/or fork lift type equipment. Heavy duty steel strapping shall be a minimum of 2 inches by 0.05 inches with two seals per band and two bands per bundle.

Ship switch timbers in a horizontal position and brace to prevent any movement that could damage the timbers.

APPLICABLE STANDARD PLANS

No. 1106

No. 1110

APPROVED:

ENGINEERING OFFICER

DATE: 10-28-92

CHIEF ENGINEERING OFFICER

SWITCH TIMBER - TREATED OAK

MATERIAL

Switch timber shall be manufactured from 100% sound oak.

Anti-splitting end plates shall be galvanized steel plate in accordance with MBTA Standard Plans.

DESIGN

Switch timbers, except headblock timbers, shall be 7 inches x 9 inches in cross section x designated even foot increments.

Headblock timbers shall be 9 inches by 10 inches in cross section and in lengths of 12, 13, or 16 feet as specified in the order.

The lengths and thicknesses specified are minimum dimensions. Timbers over one inch wider or thicker or over three inches longer, at any point, than the dimensions specified above, will be rejected.

Anti-splitting end plates shall be 6 inches by 7 inches and shall be installed in accordance with MBTA Standard Plans.

When specified in the order power switch headblocks shall be supplied framed and dowelled in accordance with MBTA Standard Plan. For treated timber headblocks install 2 dowels only from the top of the timber 4 inches from end of the framing as shown on MBTA Standard Plan.

MANUFACTURE

Switch timber shall be manufactured from sound, live timber and must be free from any defects that may impair their strength or durability as switch timber as further described in this section. Every effort should be made to get the felled timber to mill and milled timber to treatment facility for seasoning as quickly as possible, to avoid wood fiber infection.

Timbers shall be straight, well sawn on four sides, cut square at the ends, have top and bottom parallel and have bark completely removed. A switch timber will be considered straight when a straight line along the top, from the middle of one end to the middle of the other end, is entirely within the tie, and when a straight line along a side, from the middle of one end to the middle of the other end, is everywhere more than 2 inches from the top and bottom of the tie. The top and bottom will be considered parallel when any difference in the thickness at the sides and ends is less than or equal to 1/2 inch. Switch timbers shall be free from the

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following defects:

1. Decay - Switch timbers that show decay of any nature or that show stain from being left in the log too long will be rejected. "Blue stain" is not decay and is permissible in any wood.

2. Holes - Timbers will be rejected if a large hole, or numerous holes with the net effect of a large hole, is present. A large hole is one exceeding 1/2 inch in diameter and 3 inches deep or one that is more than one-fourth the width of the surface on which it appears and 3 inches deep in the areas from the ends of the timber in 12 inches.

3. Knots - Timbers with a large knot, or numerous knots with the net effect of a large knot, within the area between 12 inches from each end of the timber, will be rejected. A large knot is a knot whose average diameter is greater than one-fourth the width of the surface on which it appears.

4. Shake - Shake greater than one-third the width of the timber will be cause for rejection of the timber.

5. Split - A timber will be rejected if a split exceeds 5 inches long or 1/2 inch wide.

6. Slanting Grain - A timber will be rejected if a slant in grain in excess of 1:15 is present, except in the case of woods with interlocking grain.

7. Wane - Excessive wane will be cause for rejection of the timber.

INSPECTION

Green timbers will be inspected at the time of delivery to seasoning area. Dry timbers will be subject to inspection after seasoning and before treatment.

Inspector will make a close examination of the top, bottom, sides and ends of each timber. Each timber will be graded independently, without regard for the grading of the others in the same lot. Timbers covered with ice, or too muddied for ready examination, will be rejected. The responsibility and expense for the inspection described above will be borne by the manufacturer.

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SWITCH TIMBER - TREATED OAK

When conditions warrant, in the judgment of the Chief Engineering officer or his designee, timbers will be inspected at other points, and all timbers are subject to inspection at delivery.

SEASONING

Prior to seasoning, all switch timbers shall have nail plate anti-splitting devices applied at each end of the timber. Nail plate shall be in accordance with MBTA Standard Plans.

Switch timbers shall be air seasoned prior to treatment. Timbers shall be stacked for seasoning in accordance with AREA Specifications, Chapter 3, Part 5, Section 6. Seasoning shall continue for at least 12 months and no more than 18 months.

In the absence of air seasoned switch timbers, the Vapor or Boulton drying process may be used with the permission of the Chief Engineering Office, or his designee. If the Vapor or Boulton process is used, conditioning should continue until moisture removal rate indicates a percent moisture retained equal to a 12-month air dried switch timber, but not less than 45 percent by weight.

Sufficient borer cores shall be taken of seasoned timbers to determine that adequate drying has taken place so that timbers may be satisfactorily penetrated with preservative.

TREATMENT

Switch timber treatment shall be to retention of seven pounds or to refusal of 60/40 creosote and petroleum per cubic foot of timber in accordance with the latest AREA Manual, Chapter 3, Parts 7, 8, & 9.

Sufficient number of borings shall be taken after treatment to determine proper penetration.

Prior to treatment anti-splitting plates must be checked to ensure that plates are firmly embedded in the timber. If plates are found to be loose or not flush against the end of the timber, plate shall be firmly pressed against the timber before treatment begins.

Anti-splitting plates that are loose or not firmly against the tie end will be cause for rejection of the timber.

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SWITCH TIMBER - TREATED OAK

SUBMITTALS

Prior to shipment, the manufacturer shall submit certified inspection and test reports to the Chief Engineering Officer, or his designee, for review.

SHIPMENT

Switch timbers shall be bundled by size, in groups not exceeding 5000 pounds, with two 2 inch by 0.05 inch heavy duty steel bands with two seals per band. Wood dunnage shall be placed on the bottom of the transportation vehicle and between tiers to facilitate unloading operations.

DELIVERY

To be accepted, the timbers offered shall conform to this specification in all respects and are at the supplier's risk until acceptance at the specified delivery site. Timbers which are rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1106

No. 1110

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THERMITE WELD KIT

MATERIAL

Thermite weld kits shall contain a mixture of aluminum and iron oxide, which when ignited, produces a filler metal to fuse the rail ends together, by heat produced by the thermite reaction. Each weld kit shall also contain all molds, luting material and thimble required to complete one weld.

DESIGN

Thermite weld kits shall be self-tapping crucible type requiring minimum pre-heating as manufactured by Calorite, Inc., or approved equivalent.

QUALITY ASSURANCE

The manufacturer shall maintain comprehensive continuously operated quality control procedures to ensure that each weld kit supplied is free of flaws or defects in materials and manufacture.

TESTING

The manufacturer shall perform and certify in writing prior to shipment, that representative weld kits have successfully passed the following tests:

1. Prepare, in accordance with manufacturer's recommended procedures, three sample thermite welds on the proposed rail section and type. Rail to be supplied by the weld manufacturer.

2. Test all welds radiographically in accordance with ASTM Designation E142 "Controlling Quality of Radiographic Testing". At least four areas shall be radiographed (head, web and each side of base) with sufficient detail to detect flaws to establish the ability of the weld to meet the requirement specified herein.

   Each weld shall have full penetration and complete fusion with no evidence of surface or internal fissures. Porosity or slag type defects will be tolerated provided the radiograph shows:

   a. The largest defect does not exceed 1/8 inch in any dimension.
   b. The total area of all defects does not exceed 0.060 square inches.

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c. The sum of the greatest dimension of defects in a line shall not exceed 3/8 inch.

Non-destructive testing of welds by radiographic use of nuclear by-product material shall be conducted by a laboratory licensed by the U.S. Nuclear Regulatory Commission.

3. Subject all test welds to the Slow Bend Test as described in the Proceedings of the AREA, Volume 68. The acceptable criteria for this test shall be a minimum deflection of one inch and 100,000 pounds per square inch modulus of rupture.

SUBMITTALS

The manufacturer shall submit detailed description of Quality Assurance program used in the manufacture and handling of all weld kit components.

The manufacturer shall submit certification that the Quality Assurance program was in place and was applied to all welds kits supplied in the order.

The manufacturer shall submit certification that representative samples of the weld kits provided meet the test requirements as described herein.

The manufacturer shall provide complete detailed instructions for welding procedures including preparation, preheating and crucible tapping.

SHIPMENT

Thermite weld materials shall be shipped in kit form with each kit containing all necessary materials to complete one thermite weld. Packaging shall be water-proof to resist damage to molds and thermite charge.

DELIVERY

To be accepted, thermite weld kits offered shall conform to this specification in all respects. Thermite weld kits are subject to inspection at delivery and are at the supplier's risk until acceptance. Thermite weld kits rejected for non compliance with this specification will be returned at the supplier's expense.

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TIE PLATE - RESILIENT FASTENER

MATERIALS

New resilient fastener tie plate shall conform to AREA Manual For Railway Engineering, Chapter 5, Part 1 - "Specification For Low-Carbon Steel Tie Plates"

MANUFACTURE

Each new resilient fastener tie plate shall have 6 hole punching, 1:40 cant, and shall be in accordance with MBTA Standard Plans.

Material order shall specify plan number required.

INSPECTION

Resilient fastener tie plates are subject to inspection at delivery for compliance with these specifications.

SHIPMENT

Resilient fastener tie plates shall be handled and shipped in accordance with currently accepted practices and as specified in the order.

DELIVERY

To be accepted, resilient fastener tie plates offered shall conform to this specification in all respects. Resilient fastener tie plates are subject to inspection at delivery and are at the supplier's risk until acceptance. Resilient fastener tie plates rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1224

No. 1225

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TIE PLATE - STANDARD

MATERIALS

New standard tie plate shall conform to AREA Manual For Railway Engineering, Chapter 5, Part 1 - "Specification For Low-Carbon Steel Tie Plates"

MANUFACTURE

Each new standard tie plate shall have AREA B-6 punching, 1:40 cant and shall be in accordance with MBTA Standard Plans.

Material order shall specify plan number required.

INSPECTION

Standard tie plates are subject to inspection at delivery for compliance with these specifications.

SHIPMENT

Standard tie plates shall be handled and shipped in accordance with currently accepted practices and as specified in the order.

DELIVERY

To be accepted, standard tie plates offered shall conform to this specification in all respects. Standard tie plates are subject to inspection at delivery and are at the supplier's risk until acceptance. Standard tie plates rejected for non-compliance with this specification will be returned at the supplier's expense.

APPLICABLE STANDARD PLANS

No. 1220

No. 1222

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TIE-PLUG - CEDAR

MATERIAL

Tie plug shall be manufactured from sound, seasoned, straight grained cedar wood, free from knots and other defects.

DESIGN

The plugs shall be manufactured in two varieties, both for 5/8 inch spikes, notched and unnotched. The variety shall be specified in the material order and shall be sized as follows:

Notched tie plugs shall be in sticks of five plugs per stick. Tie plugs shall be 5/8 inch by 5/8 inch x 4½ inches.

Unnotched tie plugs shall be in sticks 5/8 inch by 5/8 inch x 22½ inches long.

TREATMENT

Cedar tie plugs shall be untreated.

SHIPMENT

Cedar tie plugs shall be bundled 100 sticks per bundle, palletized, and strapped for shipment.

DELIVERY

To be accepted, untreated Cedar tie plugs shall conform to this specification in all respects. Cedar tie plugs are subject to inspection at delivery and are at supplier's risk until acceptance. Cedar tie plugs rejected for non-compliance with this specification will be returned at supplier's expense.

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TIE-PLUG - TREATED

MATERIAL

Tie plug shall be manufactured from sound, seasoned, straight grained wood, free from knots and other defects in compliance with AREA Manual, Chapter 5, Part 1, Section 7 - "Specifications for Tie Plugs".

DESIGN

The plugs shall be manufactured in two varieties, both for 5/8 inch spikes, notched and unnotched. The variety shall be specified in the material order and shall be sized as follows:

Notched tie plugs shall be in sticks of five plugs per stick. Tie plugs shall be 5/8 inch by 5/8 inch x 4½ inches.

Unnotched tie plugs shall be in sticks 5/8 inch by 5/8 inch x 22½ inches long.

TREATMENT

Tie plugs shall be treated with a 60/40 creosote and petroleum solution with retention of 8 pounds per cubic foot in accordance with AREA Manual, Chapter 3, Part 6.

SHIPMENT

Treated tie plugs shall be bundled 100 sticks per bundle, palletized, and strapped for shipment.

DELIVERY

To be accepted, treated tie plugs shall conform to this specification in all respects. Treated tie plugs are subject to inspection at delivery and are at supplier's risk until acceptance. Treated tie plugs rejected for non-compliance with this specification will be returned at supplier's expense.

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TURNOUT - NO. 8

MATERIALS

New No. 8 turnout shall be of the rail section specified in the order. Turnout rails shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

Turnout components, unless otherwise specified herein shall be new and shall conform to the AREA Portfolio of Trackwork Plans, Specifications for Special Trackwork, Plan 100-92 Pages 1 to 11 inclusive.

DESIGN

New No. 8 turnout shall be in accordance with MBTA Standard Plan Nos. 2080; 2082; and all other MBTA Standard Plans referenced on these plans. Turnout shall be insulated.

Turnout shall be designed to be welded. Manufacturer shall provide 14 pairs of joint bars complete with 4 bolts, nuts and washers for each joint for temporary assembly prior to welding.

SUBMITTAL

Prior to manufacture the manufacturer shall submit complete shop drawings of all components of the turnout and plans and method of assembly of the turnout.

Submit results of all tests and measurements made to ensure turnout is in compliance with this specification.

Submit date when assembled turnout will be available for inspection at manufacturer's facility.

MANUFACTURE

New No. 8 turnout shall include, but not be limited to, the following components in accordance with the MBTA Standard Plans as specified by plan number.

Switch - Plan No. 2104 - 16 feet 6 inch straight split switch with heel block assemblies.

Frog - Plan No. 2084 - No. 8 Railbound Manganese Steel Frog - manganese castings to be 3 shot explosive hardened. Casting shall be radiographically tested for internal soundness by the manufacturer. (To verify radiographic testing, the qualification process may include sectioning of a casting.)

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Internal soundness of casting shall comply to radiographic testing quality standard levels, as shown on Plan No. 1012-92 in the AREA Portfolio of Trackwork Plans.

Radiographic testing shall be done in conformance with the current issue of the following ASTM Specifications:

E-94 Recommended Practice for Radiographic Testing

E-142 Controlling Quality for Radiographic Testing

E-446 Reference Radiographs up to 2 inches in thickness, (0"-2")

E-186 Reference Radiographs for Heavy Wall Steel Casting, (2"-4½")

E-280 Reference Radiographs for Heavy Wall Steel Casting, (4¼"-12")

Wing and heel rails shall be fabricated from fully-heat-treated rail in conformance with MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Standard Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Frog Plates shall be self-aligning swivel type for resilient fastener per Plan No. 2328.

Guard Rails - shall be one piece, solid manganese, 10 feet 0 inches long, per Plan No. 2300.

Rail - All rail shown on Plan No. 2082 shall be supplied with the order and shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Insulated joints shall be 36 inch, full contact, polycoated type conforming to MBTA Material Specification No. 9224 titled "Insulated Joint Kit".

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TURNOUT - NO. 8

1. When specified on the order for a No. 8 turnout provide insulated joint plug rails in conformance with MBTA Material Specification No. 9221 titled "Insulated Bonded Joint Plug Rail" and Plan No. 1340 except that rail length shall be as specified in the order. Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Tie plates shall be resilient type in accordance with MBTA Material Specification No. 9269 titled "Tie Plate-Resilient Fastener" and Plan No. 1225.

Rail fasteners shall be resilient fastener type in conformance with MBTA Material Specification No. 9245 titled "Resilient Fastener".

Joints shall be 2 bars, each 36 inch, 6 hole, short toe, headfree design in accordance with Plan No. 1322 and shall be complete with track bolts, nuts and washers per MBTA Material Specification No. 9227 titled "Joint Bars & Fastenings".

Screw spikes shall be in accordance with MBTA Material Specification No. 9246 titled "Screw Spikes".

Track Spikes to be supplied by others.

Lock Spikes to be supplied by others.

Unless otherwise specified on the order, switch timber to be supplied by others.

ASSEMBLY

Each turnout shall be fully assembled and checked for specified tolerances. Turnout shall be match marked with permanent metal marker disassembled, and packed for shipment.

SHIPMENT

Switch plates and braces shall be palletized and banded or shall be crated.

Switch rods shall be banded together.

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TURNOUT - NO. 8

Switch rails shall be banded together properly blocked to prevent damage. Stock rails and turnout rails shall be loaded heads up on blocking.

Joint bars shall be wired into pairs, palletized, and strapped for shipment. Bolts, nuts, and washers shall be packed into a keg or other suitable container.

Frog guard rails shall be blocked and banded together.

Frog Plates shall be palletized and banded or shall be crated.

Resilient tieplates and milled tie plates shall be palletized or crated.

Resilient fasteners shall be bagged or in kegs.

Screw spikes shall be in kegs.

All material for a turnout shall be shipped together properly identified as being a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the new No. 8 turnout meets the requirements of this specification and is in accordance with the MBTA Material Specifications and Standard Plans cited in this specification.

The Authority, at its option, may inspect the fully assembled turnout at the manufacturer's facility. The Authority's inspector shall have full access to manufacturer's facility for this inspection.

In addition to the manufacturer's inspection, new No. 8 turnout is subject to inspection by the Authority, or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that material supplied meets the requirements of this specification.

The manufacturer may have a representative present during this inspection if so desired.

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TURNOUT - NO. 8

DELIVERY

Turnout will be at Manufacturer's risk until accepted by the Authority.

Turnout rejected because of non-compliance with this specification will be returned at Manufacturer's expense.

APPLICABLE STANDARD PLANS

The following MBTA Plans are required for the manufacture of the turnout:

Plan Nos.	Titles
2080	NO. 8 TURNOUT BILL OF MATERIAL
2082	NO. 8 WELDED TURNOUT TIE AND RAIL LAYOUT
2104	16'-6" STRAIGHT SPLIT SWITCH
2084	NO. 8 RAILBOUND MANGANESE STEEL FROG
2106	SWITCH PLATES AND GAGE PLATES
2107	VERTICAL SWITCH RODS AND ADJUSTABLE ROCKER CLIPS
2300	10'-0" MANGANESE STEEL ONE PIECE GUARD RAIL
2328	SELF - ALIGNING SHOULDER TIE PLATES
2340	RESILIENTLY FASTENED TURNOUT PLATES
2341	TABLE OF DIMENSIONS FOR RESILIENTLY FASTENED TURNOUT PLATES
2350	HEEL BLOCK AND SWITCH RAIL STOP
2352	RESILIENTLY FASTENED ADJUSTABLE RAIL BRACE
1300	115 LB RE RAIL*
1302	132 LB RE RAIL
1320	115 LB RE JOINT BAR*
1322	132 LB RE JOINT BAR
1340	132 RE BONDED INSULATED JOINT
1225	RESILIENT FASTENER TIE PLATE FOR SCREW SPIKES
1218	SCREW SPIKES

* When specified in the order.

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TURNOUT - NO. 10

MATERIALS

New No. 10 turnout shall be of the rail section specified in the order. Turnout rails shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

All turnout components, unless otherwise specified herein, shall be new and shall conform to the AREA Portfolio of Trackwork Plans, Specifications for Special Trackwork, Plan 100-92 Pages 1 to 11 inclusive.

DESIGN

New No. 10 turnout shall be in accordance with MBTA Standard Plan Nos. 2110; 2112; and all other MBTA Standard Plans referenced on these plans. Turnout shall be insulated.

Turnout shall be designed to be welded. Manufacturer shall provide 16 pairs of joint bars complete with 4 bolts, nuts, and washers for each joint for temporary assembly prior to welding.

SUBMITTAL

Prior to manufacture the manufacturer shall submit complete shop drawings of all components of the turnout and plans and method of assembly of the turnout.

Submit results of all tests and measurements made to ensure turnout is in compliance with this specification.

Submit date when assembled turnout will be available for inspection at manufacturer's facility.

MANUFACTURE

New No. 10 turnout shall include, but not be limited to, the following components in accordance with the MBTA Standard Plans as specified by plan number.

Switch - Plan No. 2114 - 16 feet 6 inch straight split switch with 27 foot switch rails and floating heel blocks.

Frog - Plan No. 2105 - No. 10 Railbound Manganese Steel Frog - manganese castings to be 3 shot explosive hardened and casting shall be radiographically tested for internal soundness by the manufacturer. (To verify radiographic testing, the qualification process may include sectioning of a casting.)

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TURNOUT - NO. 10

Internal soundness of casting shall comply to radiographic testing quality standard levels, as shown on Plan No. 1012-92 in the AREA Portfolio of Trackwork Plans.

Radiographic testing shall be done in conformance with the current issue of the following ASTM Specifications:

E-94 Recommended Practice for Radiographic Testing

E-142 Controlling Quality for Radiographic Testing

E-446 Reference Radiographs up to 2 inches in thickness, (0"-2")

E-186 Reference Radiographs for Heavy Wall Steel Casting, (2"-4½")

E-280 Reference Radiographs for Heavy Wall Steel Casting, (4¼"-12")

Wing and heel rails shall be fabricated from fully-heat-treated rail in conformance with MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Frog Plates shall be self-aligning swivel type for resilient fastener per Plan No. 2328.

Guard Rails - shall be one piece, solid manganese, 13 feet 3 inches long, per Plan No. 2302.

Rail - All rail shown on Plan No. 2112 shall be supplied with the order and shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Insulated Joint Plug rails shall be to lengths indicated on Plan No. 2112 and shall conform to MBTA Material Specification No. 9221 titled "Insulated Bonded Joint Plug Rail" and Plan No. 1340. Rails shall be drilled per Plan No. 1300 for 115 lb rail or NO. 1302 for 132 lb rail, as specified in the order, except that

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the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Tie plates shall be resilient type in conformance with MBTA Material Specification No. 9269 titled "Tie Plate-Resilient Fastener" and Plan No. 1225.

Rail fasteners shall be resilient fastener type in conformance with MBTA Material Specification No. 9245 titled "Resilient Fastener".

Joints shall be 36 inch, 6 hole, short toe, headfree design in accordance with Plan No. 1322 and shall be complete with track bolts, nuts and washers per MBTA Material Specification No. 9227 titled "Joint Bars & Fastenings".

Screw spikes shall be in accordance with MBTA Material Specification No. 9246 titled "Screw Spikes".

Track Spikes to be supplied by others.

Lock Spikes to be supplied by others.

Unless otherwise stated in the order, switch timber to be supplied by others.

ASSEMBLY

Each Turnout shall be fully assembled and checked for specified tolerances. Turnout shall be match marked with permanent metal marker disassembled, and packed for shipment.

SHIPMENT

Switch plates and braces shall be palletized and banded or shall be crated.

Switch rods shall be banded together.

Switch rails shall be banded together properly blocked to prevent damage. Stock rails and turnout rails shall be loaded heads up on blocking.

Joint bars shall be wired into pairs, palletized, and strapped for shipment. Bolts, nuts, and washers shall be packed into a keg or other suitable container.

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TURNOUT - NO. 10

Frog guard rails shall be blocked and banded together.

Frog plates shall be palletized and banded or shall be crated.

Resilient tieplates and milled tie plates shall be palletized or crated.

Resilient fasteners shall be bagged or in kegs.

Screw spikes shall be in kegs.

All material for a turnout shall be shipped together properly identified as being a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the new No. 10 turnout meets the requirements of this specification and is in conformance with the MBTA Material Specifications and Standard Plans cited in this specification.

The Authority, at its option, may inspect fully assembled turnout at the manufacturer's facility. The Authority's inspector shall have full access to manufacturer's facility for this inspection.

In addition to the manufacturer's inspection, new No. 10 turnout is subject to inspection by the Authority, or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that material supplied meets the requirements of this specification.

The manufacturer may have a representative present during this inspection if so desired.

DELIVERY

Turnout will be at Manufacturer's risk until accepted by the Authority.

Turnout rejected for non-compliance with this specification will be returned at Manufacturer's expense.

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TURNOUT - NO. 10

APPLICABLE STANDARD PLANS

The following MBTA Plans are required for the manufacture of the turnout:

Plan Nos.	Titles
2110	NO. 10 FLOATING HEEL BLOCK TURNOUT - BILL OF MATERIAL
2112	NO. 10 TURNOUT WITH FLOATING HEEL BLOCKS - TIE & RAIL LAYOUT
2114	16'-6" STRAIGHT SPLIT SWITCH WITH FLOATING HEEL BLOCKS
2105	NO. 10 RAILBOUND MANGANESE STEEL FROG
2106	SWITCH PLATES AND GAGE PLATES - FOR 16'-6" SWITCH WITH FLOATING HEEL BLOCKS
2107	VERTICAL SWITCH RODS AND ADJUSTABLE ROCKER CLIPS
2302	13'-3" MANGANESE STEEL ONE PIECE GUARD RAIL
2328	SELF - ALIGNING SHOULDER TIE PLATES
2342	RESILIENTLY FASTENED TURNOUT PLATES - NO. 8 & 10 FLOATING HEEL BLOCK TURNOUTS
2350	HEEL BLOCK AND SWITCH RAIL STOP
2352	RESILIENTLY FASTENED ADJUSTABLE RAIL BRACE
2360	60 FT. UNDERCUT STOCK RAIL
1300	115 LB RE RAIL*
1302	132 LB RE RAIL
1320	115 LB RE JOINT BAR*
1322	132 LB RE JOINT BAR
1340	132 RE BONDED INSULATED JOINT
1225	RESILIENT FASTENER TIE PLATE FOR SCREW SPIKES
1218	SCREW SPIKES

* When specified in the order

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TURNOUT - NO. 15

MATERIALS

New No. 15 turnout shall be of the rail section specified in the order. Turnout rails shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

All turnout components, unless otherwise specified herein shall be new and shall conform to the AREA Portfolio of Trackwork Plans, Specifications for Special Trackwork, Plan 100-92 Pages 1 to 11 inclusive.

DESIGN

New No. 15 turnout shall be in accordance with MBTA Standard Plan Nos. 2160; 2162; and all other MBTA Standard Plans referenced on these plans. Turnout shall be insulated.

Turnout shall be designed to be welded. Manufacturer shall provide 19 pairs of joint bars complete with 4 bolts, nuts, and washers for each joint for temporary assembly prior to welding.

SUBMITTAL

Prior to manufacture the manufacturer shall submit complete shop drawings of all components of the turnout and plans and method of assembly of the turnout.

Submit results of all tests and measurements made to ensure turnout is in compliance with this specification.

Submit date when assembled turnout will be available for inspection at manufacturer's facility.

MANUFACTURE

New No. 15 turnout shall include, but not be limited to, the following components in accordance with the MBTA Standard Plans as specified by plan number.

Switch - Plan No. 2165 - 26 foot curved split switch with 38 foot switch rails and floating heel blocks.

Frog - Plan No. 2156 - No. 15 Railbound Manganese Steel Frog - manganese castings to be 3 shot explosive hardened. Casting shall be radiographically tested for internal soundness by the manufacturer. (To verify radiographic testing, the qualification process may include sectioning of a casting.)

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Internal soundness of casting shall comply to radiographic testing quality standard levels, as shown on Plan No. 1012-92 in the AREA Portfolio of Trackwork Plans.

Radiographic testing shall be done in conformance with the current issue of the following ASTM Specifications:

E-94 Recommended Practice for Radiographic Testing

E-142 Controlling Quality for Radiographic Testing

E-446 Reference Radiographs up to 2 inches in thickness, (0"-2")

E-186 Reference Radiographs for Heavy Wall Steel Casting, (2"-4½")

E-280 Reference Radiographs for Heavy Wall Steel Casting, (4½"-12")

Wing and heel rails shall be fabricated from fully-heat-treated rail in conformance with MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Frog Plates shall be self-aligning swivel type for resilient fastener per Plan No. 2328.

Guard Rails - shall be one piece, solid manganese, 13 feet 3 inches long, per Plan No. 2302.

Rail - All rail shown on Plan No. 2162 shall be supplied with the order and shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Insulated Joint Plug rails shall be to lengths indicated on Plan No. 2162 and shall conform to MBTA Material Specification No. 9221 titled "Insulated Bonded Joint Plug Rail" and Plan No. 1340. Rails shall be drilled per Plan No. 1300 for 115 lb rail or NO. 1302 for 132 lb rail, as specified in the order, except that

the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Tie plates shall be resilient type in conformance with MBTA Material Specification No. 9269 titled "Tie Plate-Resilient Fastener" and Plan No. 1225.

Rail fasteners shall be resilient fastener type in conformance with MBTA Material Specification No. 9245 titled "Resilient Fastener".

Joints shall be 36 inch, 6 hole, short toe, headfree design in accordance with Plan No. 1322 and shall be complete with track bolts, nuts and washers per MBTA Material Specification No. 9227 titled "Joint Bars & Fastenings".

Screw spikes shall be in accordance with MBTA Material Specification No. 9246 titled "Screw Spikes".

Track Spikes to be supplied by others.

Lock Spikes to be supplied by others.

Unless otherwise specified on the order switch timber to be supplied by others.

ASSEMBLY

Each turnout shall be fully assembled and checked for specified tolerances. Turnout shall be match marked with permanent metal marker disassembled, and packed for shipment.

SHIPMENT

Switch plates and braces shall be palletized and banded or shall be crated.

Switch rods shall be banded together.

Switch rails shall be banded together properly blocked to prevent damage. Stock rails and turnout rails shall be loaded heads up on blocking.

Joint bars shall be wired into pairs, palletzied, and strapped for shipment. Botls, nuts, and washers shall be packed into a keg or other suitable container.

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Frog guard rails shall be blocked and banded together.

Frog plates shall be palletized and banded or shall be crated.

Resilient tieplates and milled tie plates shall be palletized or crated.

Resilient fasteners shall be bagged or in kegs.

Screw spikes shall be in kegs.

All material for a turnout shall be shipped together properly identified as being a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the new No. 15. turnout meets the requirements of this specification and conforms to the MBTA Material Specifications and Standard Plans cited in this specification.

The Authority, at its option, may inspect fully assembled turnout at the manufacturer's facility. The Authority's inspector shall have full access to manufacturer's facility for this inspection.

In addition to the manufacturer's inspection, new No. 15 turnout is subject to inspection by the Authority, or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that all material supplied meets the requirements of this specification.

The manufacturer may have a representative present during this inspection if so desired.

DELIVERY

Turnout will be at Manufacturer's risk until accepted by the Authority.

Turnout rejected because of non-compliance with this specification will be returned at Manufacturer's expense.

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TURNOUT - NO. 15

APPLICABLE STANDARD PLANS

The following MBTA Plans are required for the manufacture of the turnout:

Plan Nos.	Titles
2160	NO. 15 FLOATING HEEL BLOCK TURNOUT - BILL OF MATERIAL
2162	NO. 15 TURNOUT WITH FLOATING HEEL BLOCKS-TIE AND RAIL LAYOUT
2165	26'-0" CURVED SPLIT SWITCH WITH FLOATING HEEL BLOCKS
2156	NO. 15 RAILBOUND MANGANESE STEEL FROG
2157	SWITCH PLATES AND GAGE PLATES FOR 26'-0" SWITCH WITH FLOATING HEEL BLOCKS
2158	VERTICAL SWITCH RODS AND ADJUSTABLE ROCKER CLIPS
2302	13'-3" MANGANESE STEEL ONE PIECE GUARD RAIL
2343	RESILIENTLY FASTENED TURNOUT PLATES - NO. 15 & 20 FLOATING HEEL BLOCK TURNOUTS
2328	SELF - ALIGNING SHOULDER TIE PLATES
2350	HEEL BLOCK AND SWITCH RAIL STOP
2352	RESILIENTLY FASTENED ADJUSTABLE RAIL BRACE
2360	60 FT. UNDERCUT STOCK RAIL
1300	115 LB RE RAIL*
1302	132 LB RE RAIL
1320	115 LB RE JOINT BAR*
1322	132 LB RE JOINT BAR
1340	132 RE BONDED INSULATED JOINT
1225	RESILIENT FASTENER TIE PLATE FOR SCREW SPIKES
1218	SCREW SPIKES

* When specified in the order.

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TURNOUT - NO. 20

MATERIALS

New No. 20 turnout shall be of the rail section specified in the order. All turnout rails shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running".

All turnout components, unless otherwise specified herein shall be new and shall conform to the AREA Portfolio of Trackwork Plans, Specifications for Special Trackwork, Plan 100-92 Pages 1 to 11 inclusive.

DESIGN

New No. 20 turnout shall be in accordance with MBTA Standard Plan Nos. 2210; 2212; and all other MBTA Standard Plans referenced on these plans. Turnout shall be insulated.

Turnout shall be designed to be welded. Manufacturer shall provide 20 pairs of joint bars complete with 4 bolts, nuts and washers for each joint for temporary assembly prior to welding.

SUBMITTAL

Prior to manufacture the manufacturer shall submit complete shop drawings of all components of the turnout and plans and method of assembly of the turnout.

Submit results of all tests and measurements made to ensure turnout is in compliance with this specification.

Submit date when assembled turnout will be available for inspection at manufacturer's facility.

MANUFACTURE

New No. 20 turnout shall include, but not be limited to, the following components in accordance with the MBTA Standard Plans as specified by plan number.

Switch - Plan No. 2215 - 39 foot curved split switch with 59 foot - 6 inch switch rails and floating heel blocks.

Frog - Plan No. 2206 - No. 20 Railbound Manganese Steel Frog - manganese castings to be 3 shot explosive hardened. Casting shall be radiographically tested for internal soundness by the manufacturer. (To verify radiographic testing, the

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qualification process may include sectioning of a casting.)

Internal soundness of casting shall comply to radiographic testing quality standard levels, as shown on Plan No. 1012-92 in the AREA Portfolio of Trackwork Plans.

Radiographic testing shall be done in conformance with the current issue of the following ASTM Specifications:

E-94 Recommended Practice for Radiographic Testing

E-142 Controlling Quality for Radiographic Testing

E-446 Reference Radiographs up to 2 inches in thickness, (0"-2")

E-186 Reference Radiographs for Heavy Wall Steel Casting, (2"-4½")

E-280 Reference Radiographs for Heavy Wall Steel Casting, (4½"-12")

Wing and heel rails shall be fabricated from fully-heat-treated rail in conformance with MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Frog Plates shall be self-aligning swivel type for resilient fastener per Plan No. 2328.

Guard Rails - shall be one piece, solid manganese, 13 foot 3 inches long, per Plan No. 2302.

Rail - All rail shown on Plan No. 2212 shall be supplied with the order and shall be fully-heat-treated per MBTA Material Specification No. 9233 titled "Rail - High Strength Running". Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Insulated Joint Plug rails shall be to lengths indicated on Plan No. 2212 and shall conform to MBTA Material Specification No. 9221 titled "Insulated Bonded Joint Plug Rail" and Plan No. 1340.

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Rails shall be drilled per Plan No. 1300 for 115 lb rail or No. 1302 for 132 lb rail, as specified in the order, except that the first hole, nearest the rail end, shall be omitted. Drill two holes only for each rail end.

Tie plates shall be resilient type in conformance with MBTA Material Specification No. 9269 titled "Tie Plate-Resilient Fastener" and Plan No. 1225.

Rail fasteners shall be resilient fastener type in conformance with MBTA Material Specification No. 9245 titled "Resilient Fastener".

Joints shall be 36 inch, 6 hole, short toe, headfree design in accordance with Plan No. 1322 and shall be complete with track bolts, nuts and washers per MBTA Material Specification No. 9227 titled "Joint Bars and Fastenings".

Screw spikes shall be in accordance with MBTA Material Specification No. 9246 titled "Screw Spikes".

Track Spikes to be supplied by others.

Lock Spikes to be supplied by others.

Unless otherwise specified in the order, switch timber to be supplied by others.

ASSEMBLY

Each turnout shall be fully assembled and checked for specified tolerances. Turnout shall be match marked with permanent metal marker disassembled, and packed for shipment.

SHIPMENT

Switch plates and braces shall be palletized and banded or shall be crated.

Switch rods shall be banded together.

Switch rails shall be banded together properly blocked to prevent damage. Stock rails and turnout rails shall be loaded heads up on blocking.

Frog guard rails shall be blocked and banded together.

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Frog Plates shall be palletized and banded or shall be crated.

Resilient tieplates and milled tie plates shall be palletized or crated.

Joint bars shall be wired into pairs, palletized, and strapped for shipment. Bolts, nuts, and washers shall be packed into a keg or other suitable container.

Resilient fasteners shall be bagged or in kegs.

Screw spikes shall be in kegs.

All material for a turnout shall be shipped together properly identified as being a unit.

INSPECTION

The manufacturer shall be responsible for all tests and inspections necessary to ensure that the new No. 20 turnout meets the requirements of this specification and is in conformance with the MBTA Material Specifications and Standard Plans cited in this specification.

The Authority, at its option, may inspect fully assembled turnout at the manufacturer's facility. The Authority's inspector shall have full access to manufacturer's facility for this inspection.

In addition to the manufacturer's inspection, new No. 20 turnout is subject to inspection by the Authority, or approved designee, at delivery, for conformance with this specification. The inspection at delivery shall include, but not be limited to, visual inspection and measurements to verify that all material supplied meets the requirements of this specification.

The manufacturer may have a representative present during this inspection if so desired.

DELIVERY

Turnout will be at Manufacturer's risk until accepted by the Authority.

Turnout rejected because of non-compliance with this specification will be returned at Manufacturer's expense.

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TURNOUT - NO. 20

APPLICABLE STANDARD PLANS

The following MBTA Plans are required for the manufacture of the turnout:

Plan Nos.	Titles
2210	NO. 20 FLOATING HEEL BLOCK TURNOUT - BILL OF MATERIAL
2212	NO. 20 TURNOUT WITH FLOATING HEEL BLOCKS - TIE AND RAIL LAYOUT
2215	39' CURVED SPLIT SWITCH WITH FLOATING HEEL BLOCKS
2206	NO. 20 RAILBOUND MANGANESE STEEL FROG
2207	SWITCH PLATES AND GAGE PLATES
2208	VERTICAL SWITCH RODS AND ADJUSTABLE ROCKER CLIPS
2209	TYPICAL POWER SWITCH LAYOUT WITH HELPER
2302	13'-3" MANGANESE STEEL ONE PIECE GUARD RAIL
2328	SELF - ALIGNING SHOULDER TIE PLATES
2343	RESILIENTLY FASTENED TURNOUT PLATES - NO. 15 & 20 FLOATING HEEL BLOCK TURNOUTS
2350	HEEL BLOCK AND SWITCH RAIL STOP
2352	RESILIENTLY FASTENED ADJUSTABLE RAIL BRACE
2360	60 FT. UNDERCUT STOCK RAIL
1300	115 LB RE RAIL*
1302	132 LB RE RAIL
1320	115 LB RE JOINT BAR*
1340	132 RE BONDED INSULATED JOINT
1322	132 LB RE JOINT BAR
1225	RESILIENT FASTENER TIE PLATE FOR SCREW SPIKES
1218	SCREW SPIKES

* When specified on the order.

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